Latest Technology Used for Support by the Naval Meteorology and Oceanography Command

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INTRODUCTION

The Naval Meteorology and Oceanography Command is located in southern Mississippi on the Gulf Coast under the command of Rear Admiral Thomas Q. Donaldson, V.

The command is responsible for providing environmental support to the Department of Defense including meteorology and oceanography. Facilities and personnel are located worldwide, Figure 1, including aboard U.S. Navy ships. As we move into the 21st century, new technology is being applied to improve support.

NEW TECHNOLOGY AND SUPPORT

The Naval Meteorology and Oceanography Command is planning to provide support to a future Navy that will be extremely different than that of the 1980's and 1990's. A Navy that will depend on communications and support from shore establishments with fewer personnel at sea on ships.

To achieve this goal, several new technologies will be deployed and other technologies improved to provide better support. We now have eight modern oceanographic survey ships in service (Figures 2 & 3). A robust communications system (Figure 4) will be deployed on our ships to permit rapid transmission of large volumes of data for use in near real time support [1]. The shore facilities will be able to rapidly process, quality control, and merge the data for improved products in near real time taking advantage of shore computation facilities and other source data such as satellite and remote sensor data.

These ships have also been equipped with Hydrographic Survey Launches (Figure 5) for survey operations in shallow water areas. The launches will be used in ports and harbors and will survey at the same time that the survey ship is working. These launches will be moved to different platforms as the requirements dictate.

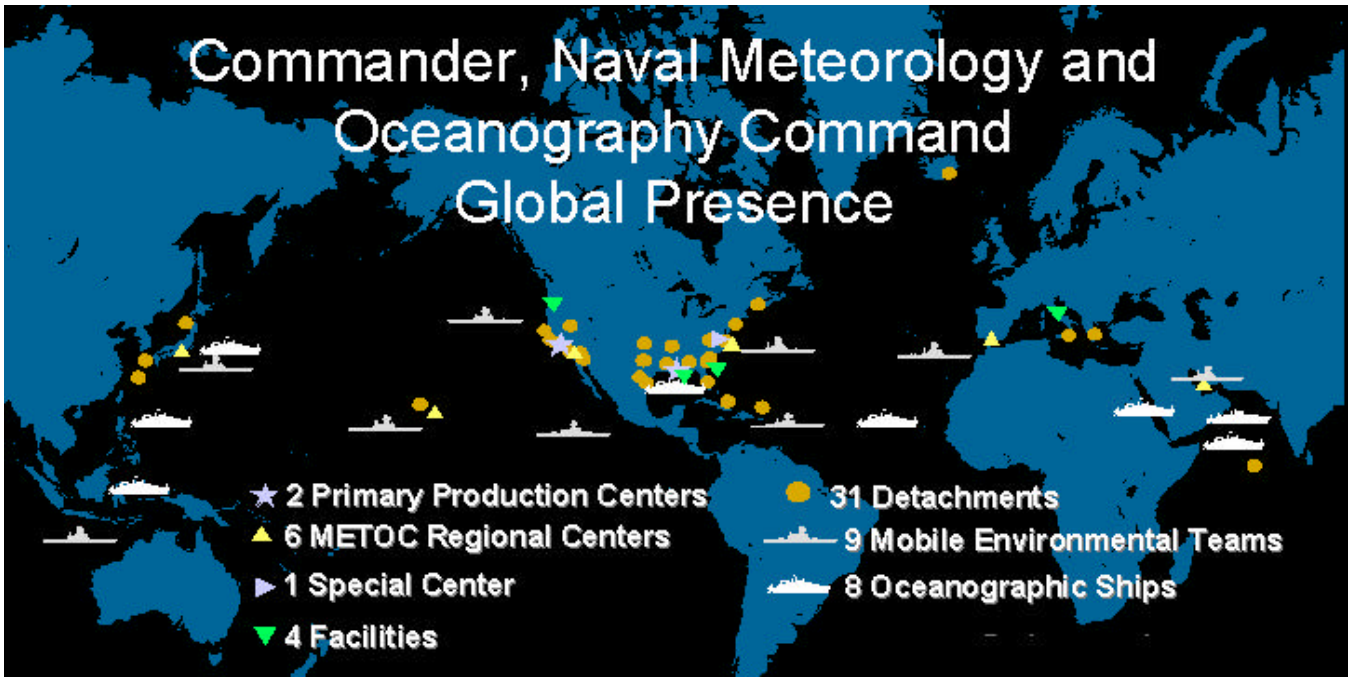

Figure 1

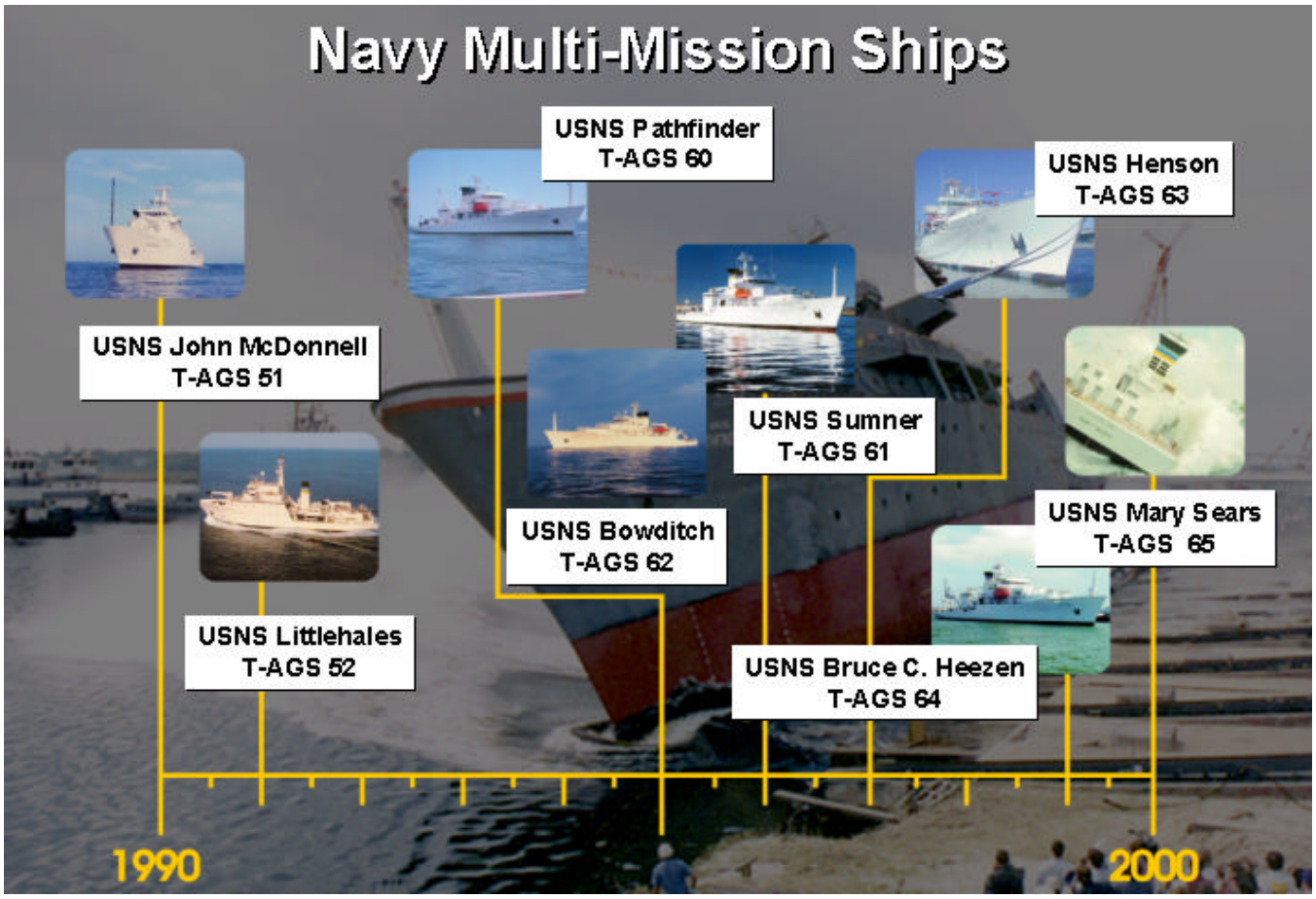

Figure 2

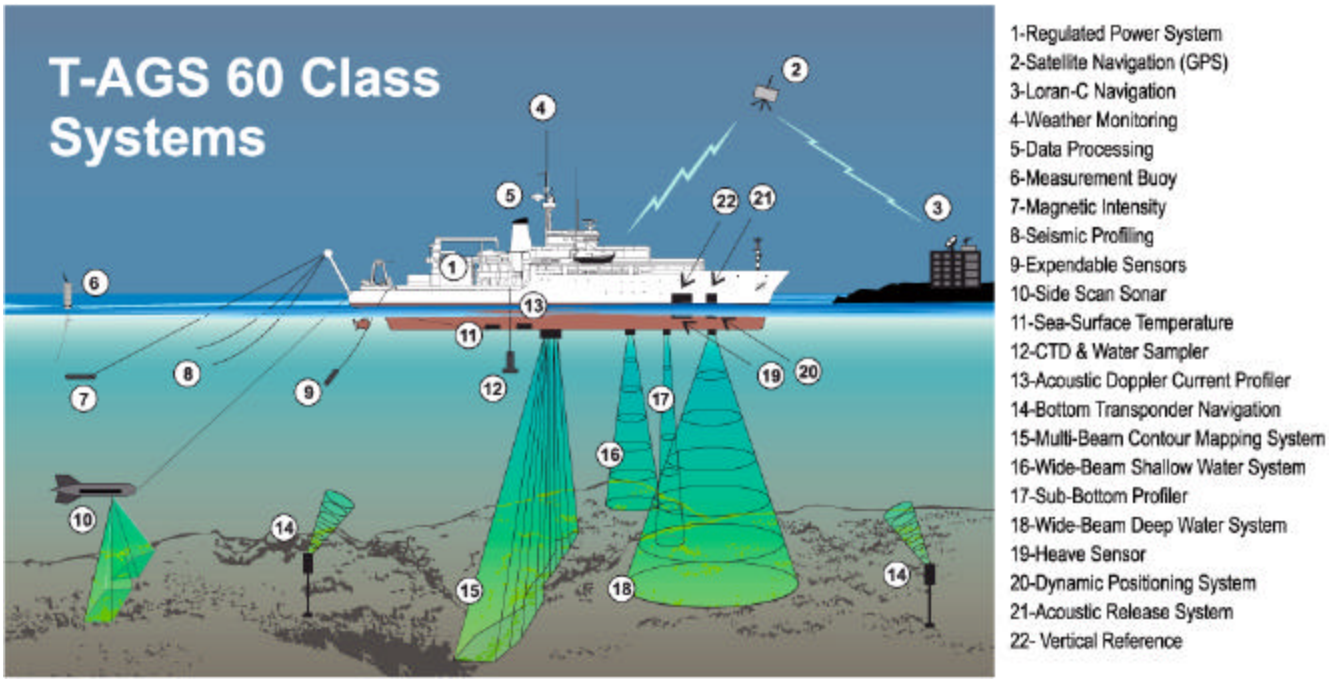

Figure 3

Figure 4

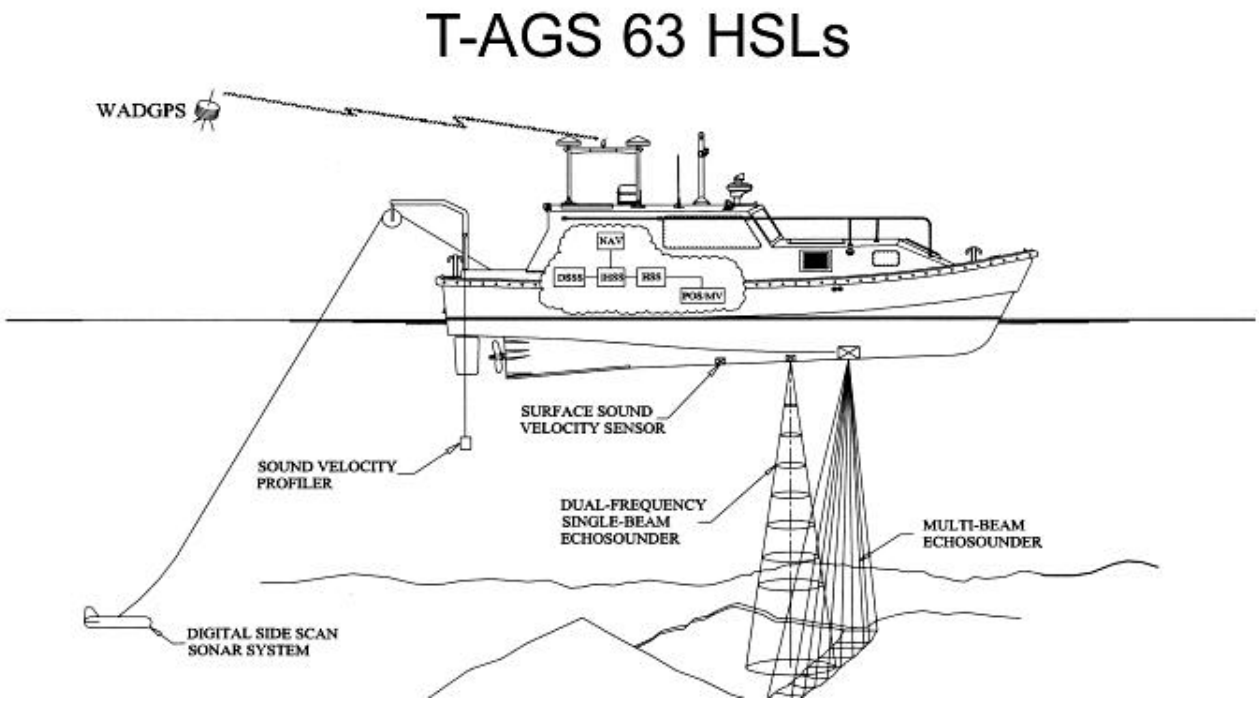

Figure 5

Our Autonomous Undersea Vehicle (AUV) program is well underway with the construction of two "SEAHORSE" vehicles (Figure 6) being tested for deployment. SEAHORSE will augment the survey ships and be used for survey operations at the same time that the ship is surveying. With the extended range of the vehicle, it can be used in areas not suited for the hydrographic launches. The vehicles will be deployed for actual operations in early 2002. The Towed Oceanographic Survey System, TOSS, Figures 7 & 8, is used for high-resolution optical and acoustic surveys in both shallow and deep-water areas. The TOSS system is being augmented with a AUV that is controlled via the TOSS sensor to increase the area covered during survey operations. The characteristics of the new AUV are shown in Figure 9.

Figure 6

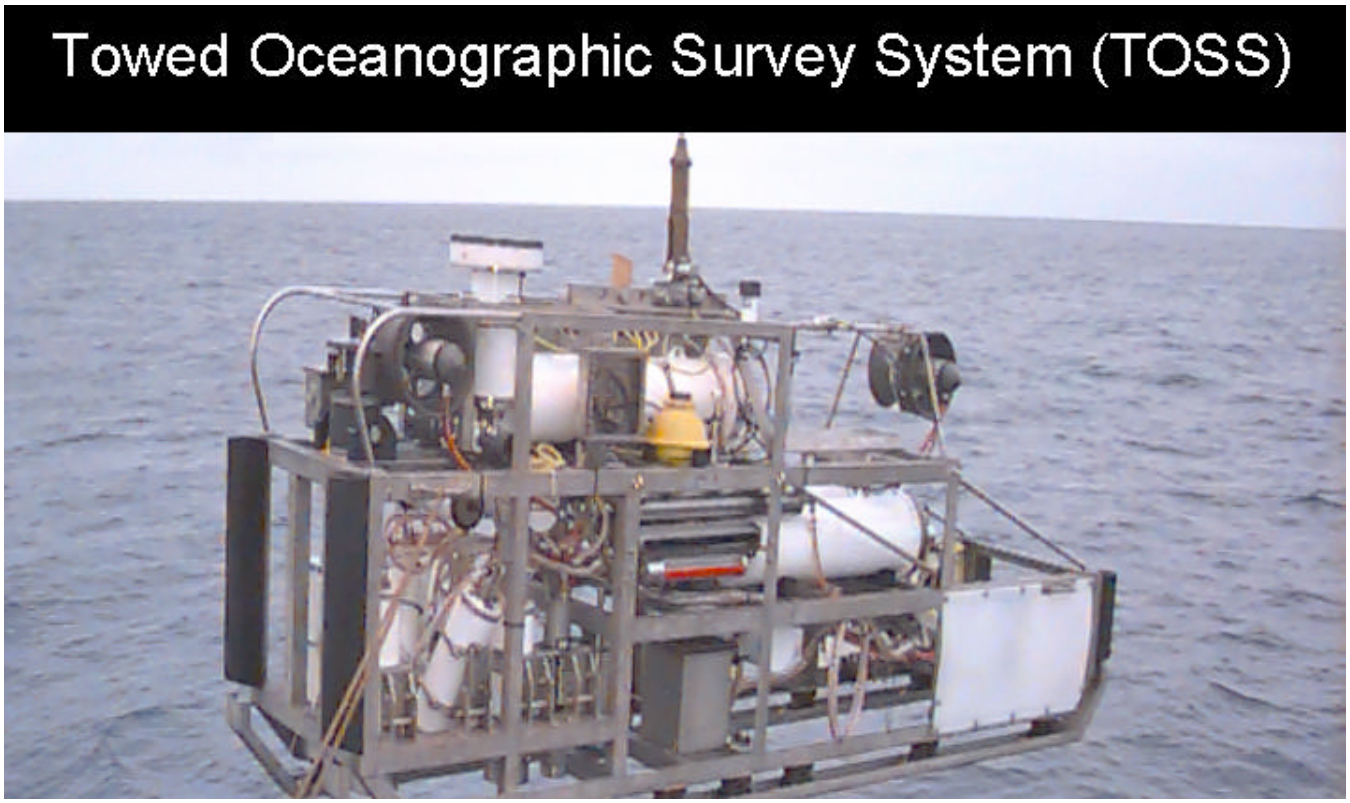

Figure 7

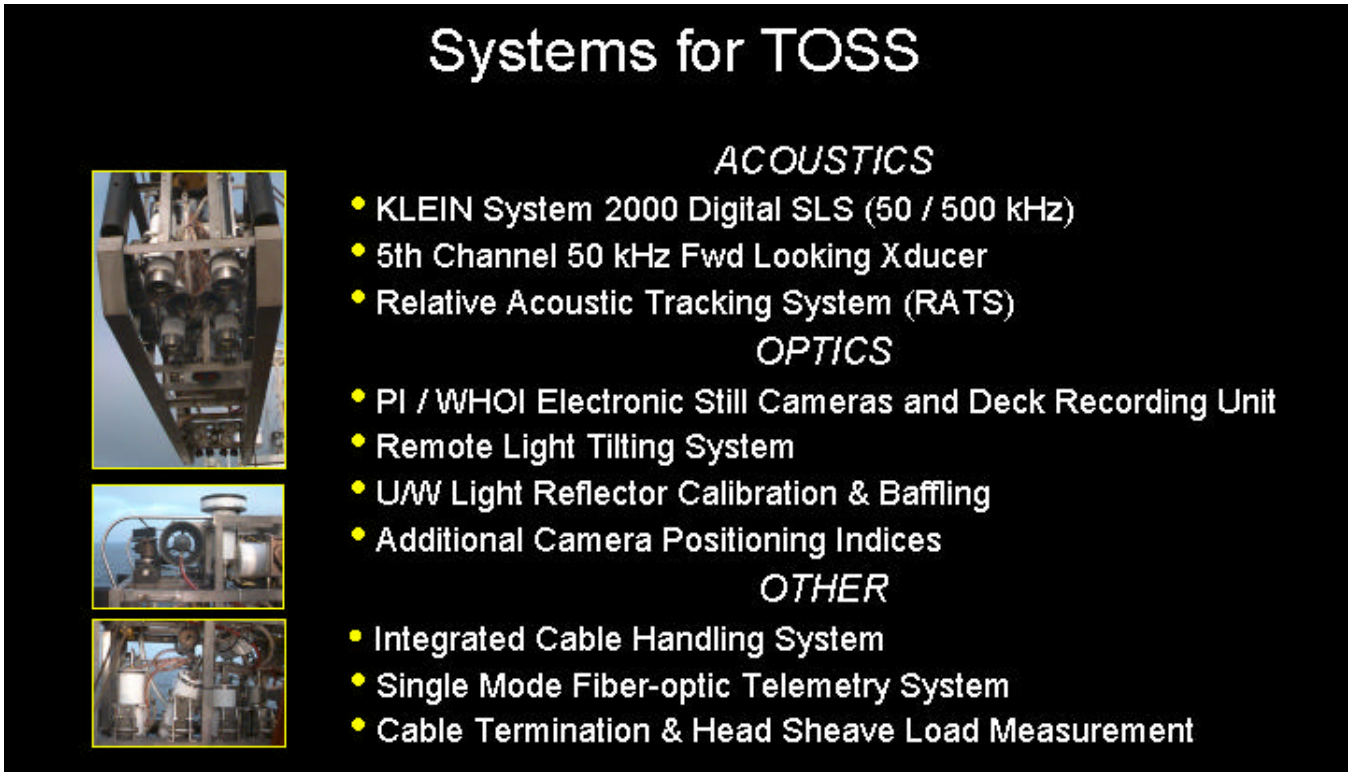

Figure 8

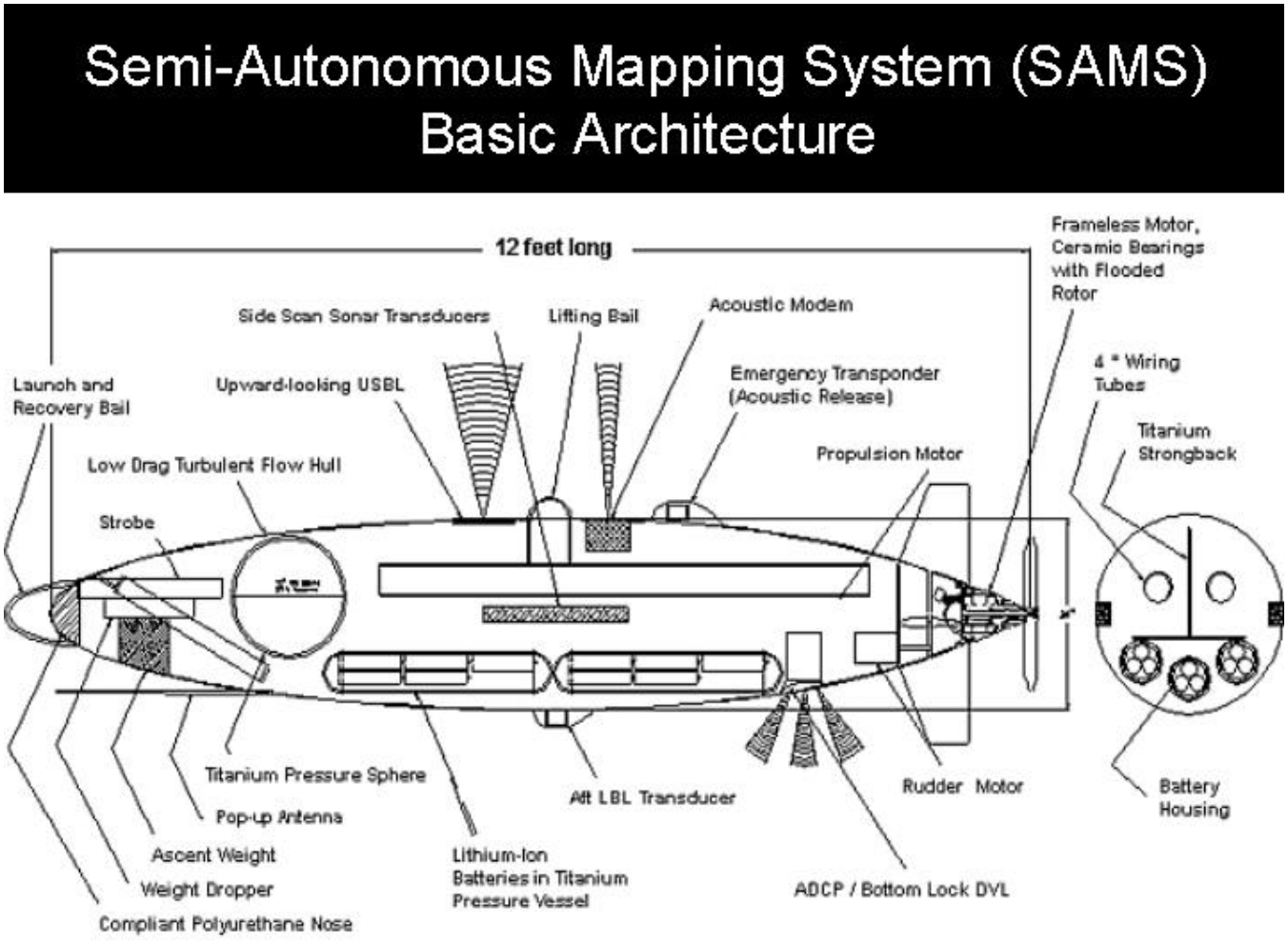
Semi-Autonomous Mapping System (SAMS)
Basic Architecture
12 feet long
Frameless Motor, Ceramic Bearings with Flooded Rotor
Side Scan Sonar Transducers
Lifting Bail
Acoustic Modem
Launch and Recovery Bail
Upward-looking USBL
Emergency Transponder (Acoustic Release)
4 " Wiring Tubes
Titanium Strongback
Low Drag Turbulent Flow Hull
Propulsion Motor
Strobe
Titanium Pressure Sphere
Pop-up Antenna
Ascent Weight
Weight Dropper
Compliant Polyurethane Nose
Att LBL Transducer
Lithium-Ion Batteries in Titanium Pressure Vessel
Rudder Motor
ADCP / Bottom Lock DVL
Battery Housing

Figure 9

In cooperation with the U.S. Army Corps of Engineers a hydrographic laser mapping system has been used for a number of survey operations in shallow water areas [2]. The Scanning Hydrographic Operational Airborne Lidar System (SHOALS) system is owned by the U.S. Army Corps of Engineers (USACE), operated by John E. Chance & Assoc. Inc., and manufactured by Optech Inc. SHOALS is managed through the Joint Airborne Lidar Technical Center of Expertise (JALBTCX), a parternship between the USACE and the Naval Meteorology and Oceanography Command. The system is currently flying in a DHC-6/300 Twin Otter. Through JALBTCX developments are underway to field a Compact Hydrographic Airborne Rapid Total Survey System, CHARTS, that will be capable of operating from a wide variety of commercially available aircraft for a rapid response to requirements, Figure 10. A second system, the Bathymeteric and Topographic Survey System, or BATS, is being developed as a tactical sensor capable of operating from an unmanned aerial vehicle, UAV, and with a 400Hz laser, Figure 11. Characteristics of the two systems are shown in Figure 12. The CHARTS system will begin field operations in late 2003 and BATS in 2004

Figure 10

Unmanned Aerial Vehicle (UAV)

The second system, BATS (Bathymetric And Topographic Survey), will be a tactical sensor capable of operating from an unmanned aerial vehicle (UAV). BATS will use a 400 Hz laser. BATS will include all the capabilities currently operational on SHOALS and will be operational in early 2004

Figure 11

Summary of CHARTS & BATS System Performance Requirements

Parameter	CHARTS Requirements	BATS UAV Requirements
Depth Measurement	+0 < depth < 50 meters	+0 < depth < 30 meters
Operational Altitude	Hydro: 200m < alt < 400 m Topo. 300m< alt.< 700m	Hydro: 200m < alt < 400 m Topo. 300m< alt.< 700m
Aircraft Speed	125 to 175 knots (nominal)	40 to 80 knots (nominal)
Laser Spot Spacing	2x2,3x3,4x4,5x5 meters	2x2,3x3,4x4,5x5 meters
Vertical & Horizontal accuracy of Soundings & Elevations	IHO Order 1 or better	IHO Order 2 (Hydro) Dependent on UAV GPS (topo)
Airborne Sensor Weight	210 Kg or less	100 Kg or less
Airborne Sensor Size	m^3	m^3

Figure 12

A major effort in the data acquisition area will make use of the sensors that are deployed on other Navy platforms (Through-the-Sensor-Technology Program) and will include data from ships, aircraft, submarines, and helicopters using a number of acoustic systems that can provide valuable data for our data bases. In addition sensors on the new Mine Hunting Vehicle and similar systems will be used to collect oceanographic data, Figure 13.

Figure 14 is a good summary of present and future plans for data acquisition to support both meteorological and oceanographic programs and represent collection systems from satellite, aircraft, unmanned underwater/surface/aerial vehicles, floating sensors, bottom sensors and remote miniature weather stations. Communications will be critical to assimilate the data in real time in order to analyze and exploit the information and to understand and predict the environment.

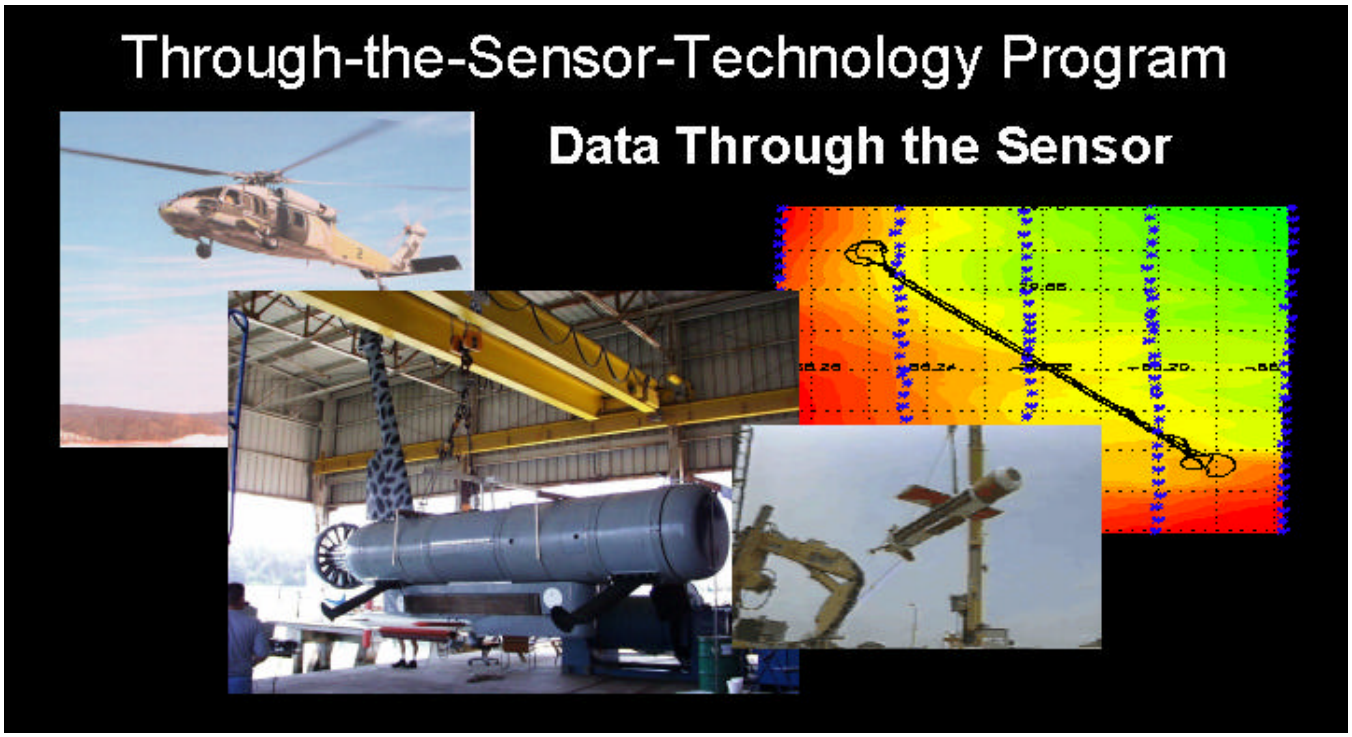

Figure 13

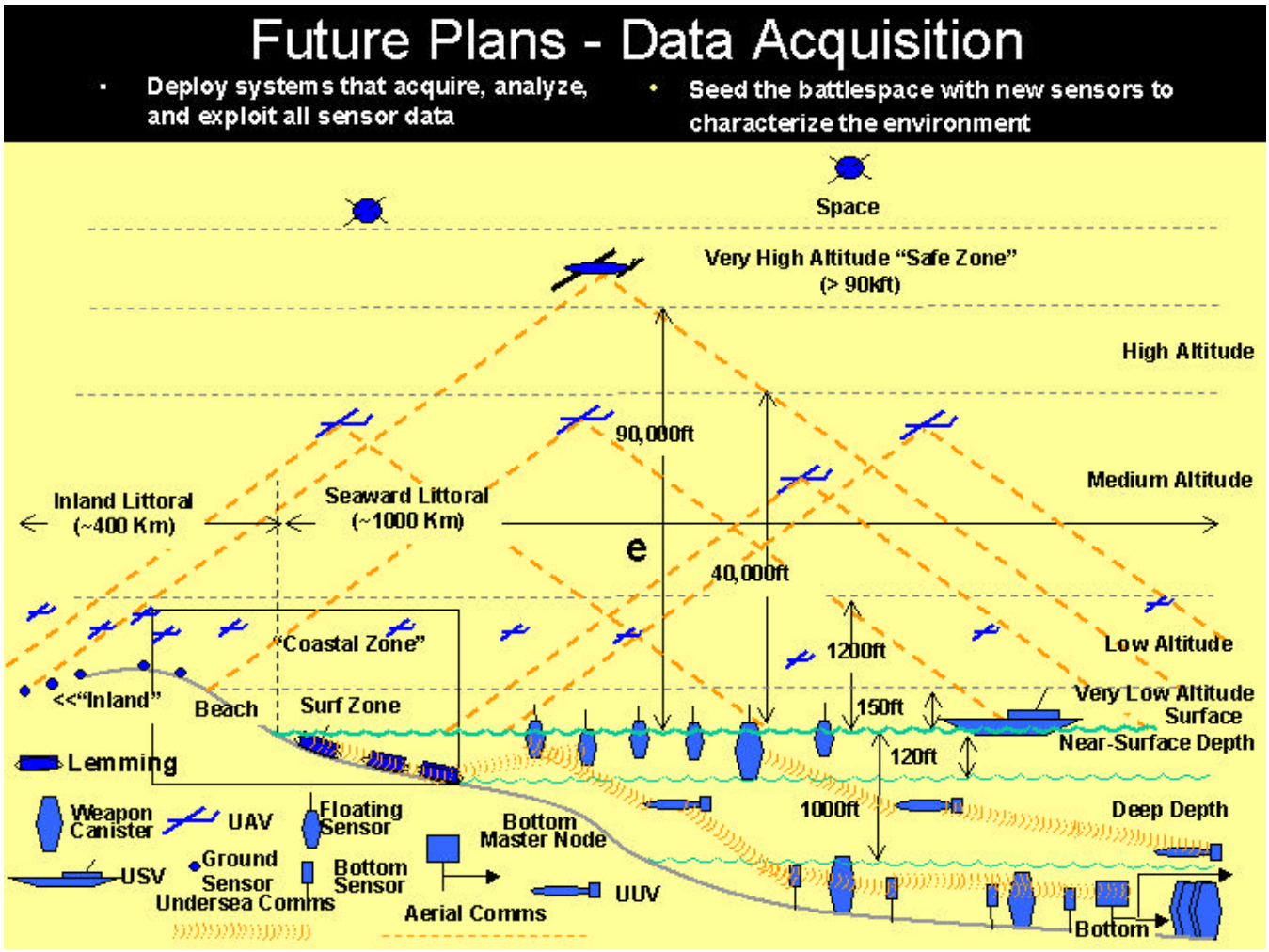

Figure 14

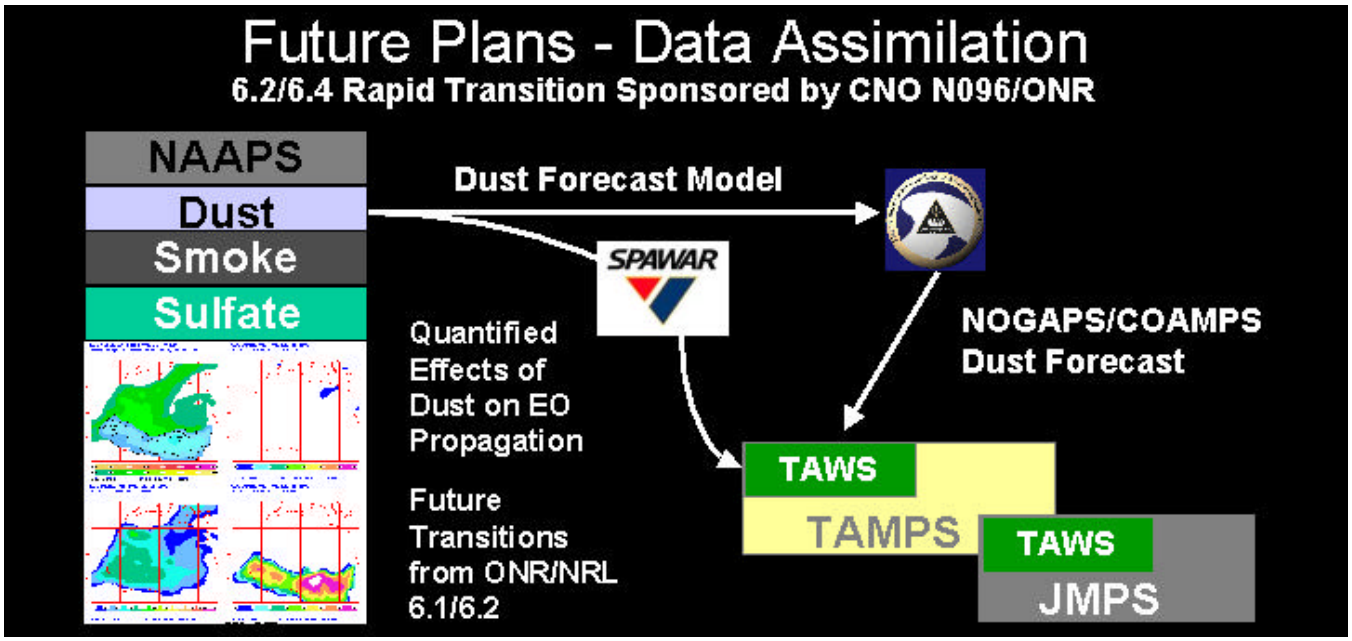

Figure 15

Satellite data used in our products include the passive microwave, scatterometry, visual and infrared imagery, multispectral, altimetery, and SAR data. The SEAWIFS sensor on Orbview-2 is now measuring ocean color that is being used to produce chlorophyl and water clarity/visibility products for use by our Fleet customers [3]. SEAWIFS is also showing promise in detecting sand, dust and aerosols. Future plans in data assimilation includes transitioning R&D models to predict the effects of the environment on EM/EO propagation and slant range visibility in 2003, Figure 15. Plans are also to extend the vertical limit of the Navy Operation Global Atmospheric Prediction System, NOGAPS, to a vertical limit of 100km and to investigate the assimilation and modeling of stratospheric ozone data, Figure 16.

SUMMARY

The plan for the present and future is to improve our data acquisition, assimilation and application process by collecting additional atmospheric and oceanographic data with autonomous vehicles, satellites, in-situ equipment, Through-the-Sensor-Technology, and modern oceanographic ships. We will continue to improve quality control procedures and disseminate collected data in real time for use in running oceanographic and atmospheric models for forecasts and producing Tactical Decision Aids for the Fleet, Figure 17.

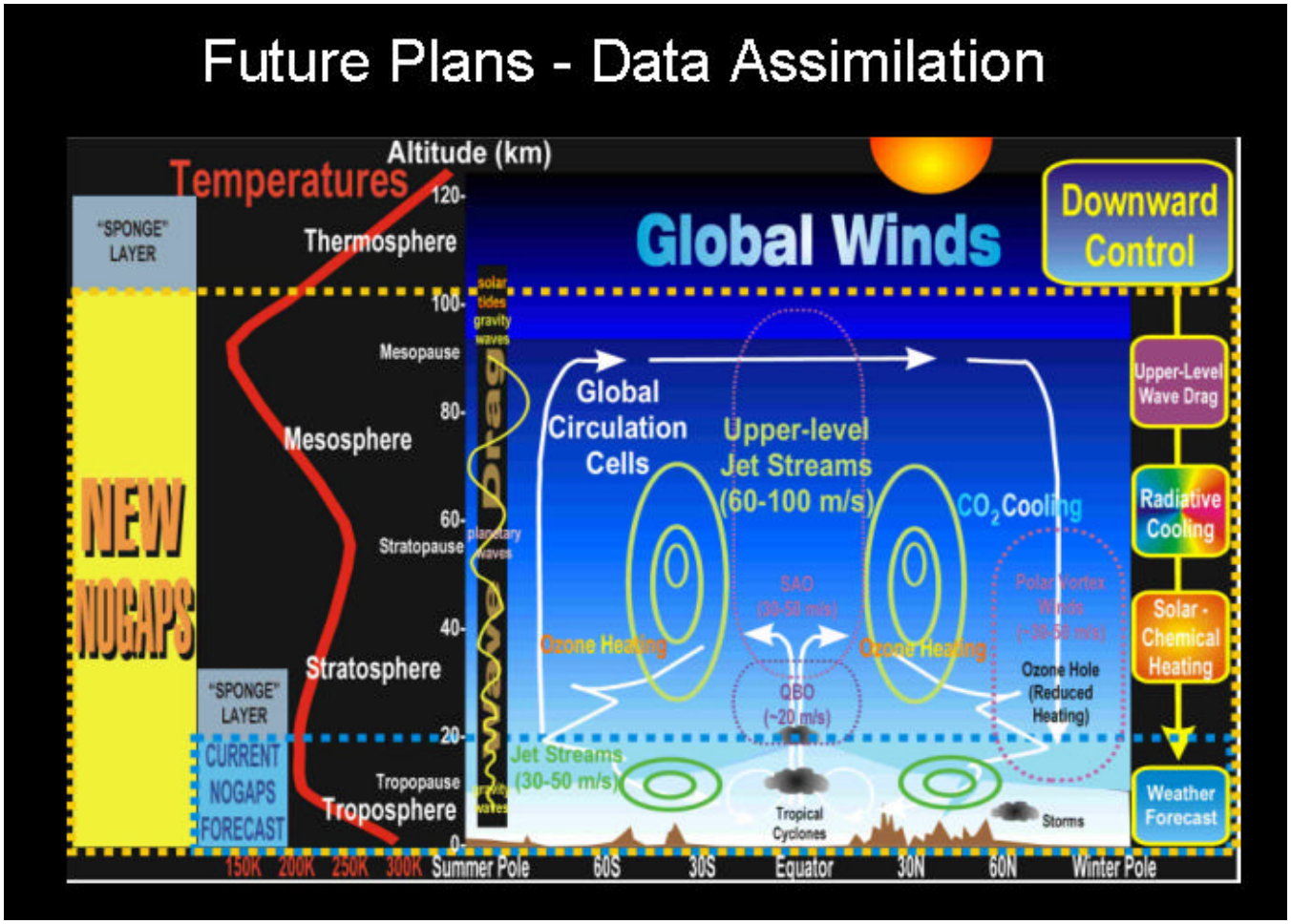

Figure 16

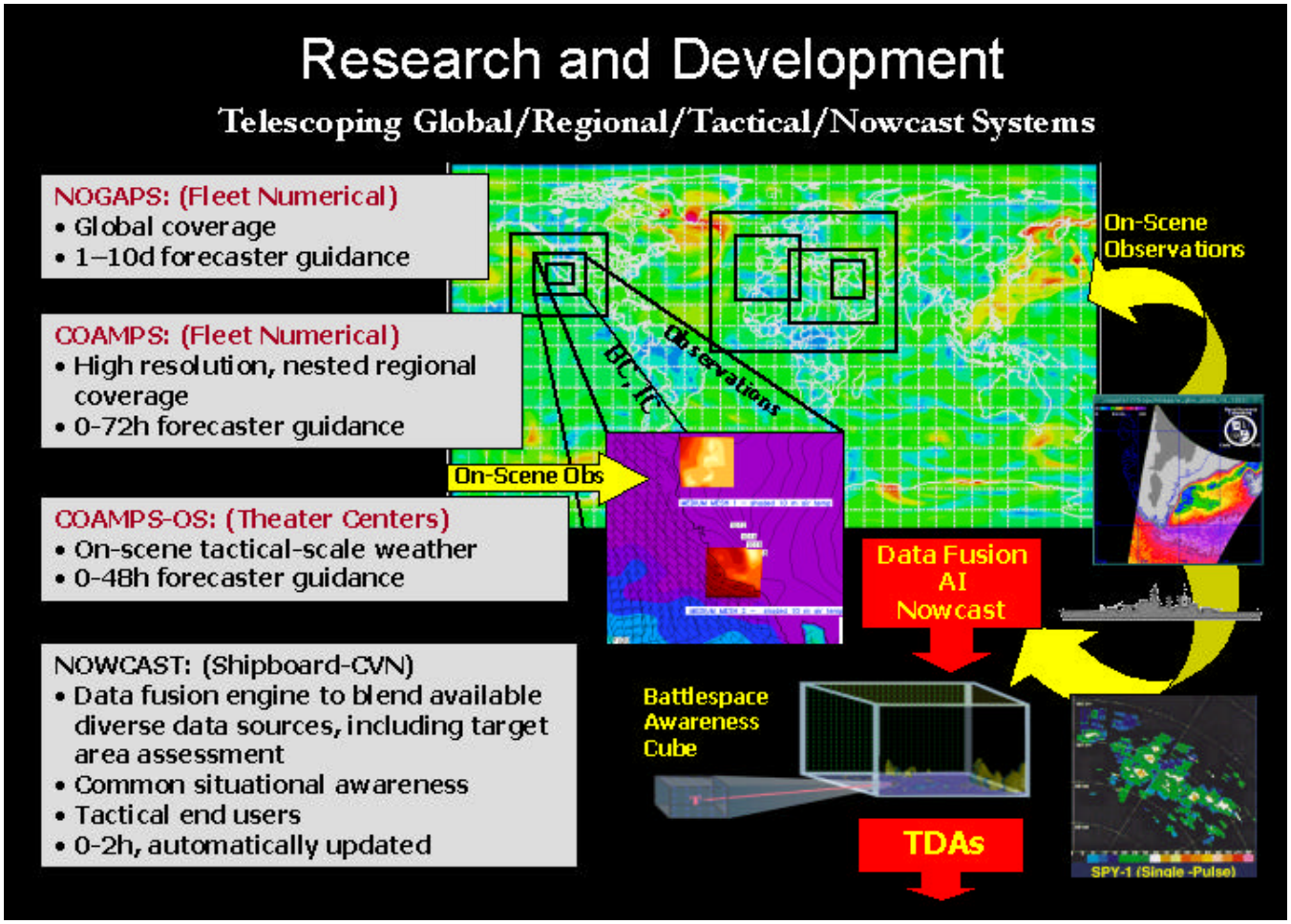

Figure 17

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[1] Raffa, Stanley and Steven Douglas, "A Broadband Ship-to-Shore Communications Network For The Naval Oceanographic Office", In Print-OCEANS 2001 MTS/IEEE

[2] West, Garrint w., Jeff Lillycrop and Robert W. Pope, "Keeping A Low Profile", HYDRO International, May-June 2001, pages 28-31

[3] Conlee, Don T. and Richard L. Crout, "Satellite Utilization By U S Navy Meteorology and Oceanography", Eleventh Conference on Satellite Meteorology and Oceanography, 15 - 18 October 2001, Madison Wisconsin, (preprint)